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THE AMERICAN ANTHROPOLOGIST.

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No. 1.

A QUARRY WORKSHOP OF THE FLAKED-STONE IMPLEMENT MAKERS IN THE DISTRICT OF COLUMBIA.*

BY W. H. HOLMES.

In this paper I desire to present a brief account of recent archæological investigations in the suburbs of the city of Washington. The work is yet incomplete, but as winter has put an end to operations in the field it is deemed best that the results thus far obtained should be brought to the attention of archæologists.

Heretofore I have taken little part in the discussion of questions pertaining to local archæology, as the evidence presented did not seem to be conclusive in any direction. The present exploration has been undertaken, therefore, without preconceived notions of what the results should be, and the conclusions are based almost entirely upon facts and arguments pertaining to and derived from my own investigation. Some conclusions of importance have been definitely reached and numerous questions have been answered. Some of the results were unexpected and some may at first seem a little startling, but I am happy to say that every tendency has been toward the simplification of what was in many respects a most perplexing problem.

THE RELICS.

From time to time during the past decade the attention of archæologists has been called to a class of rudely worked stones found in great numbers in the vicinity of this city. They are all shaped exclusively by chipping, and are of forms usually classed as palæolithic, the best-known variety being the so-called "turtle-back;" but other forms of less striking character, although more highly elaborated and interesting, are almost equally numerous.

* Read before the Society Nov. 16, 1889.

So numerous, indeed, are these objects in certain localities that they are brought in with every load of gravel from the creek beds, and the laborer who sits by the way-side breaking bowlders for our streets each year passes them by thousands beneath his hammer ; and it is literally true that this city, the capital of a civilized nation, is paved with the art remains of a race who occupied its site in the shadowy past, and whose identity until now has been wholly a matter of conjecture.

PREVIOUS STUDY.

The first discussion of these objects within my memory occurred at a meeting of the Anthropological Society of Washington in the winter of 1878. A paper upon the turtle-backs was read by Dr. W. J. Hoffman, in which their character, manner of occurrence, age, and relations to the Abbott finds of New Jersey were discussed. Later Mr. S. V. Proudfit engaged in the collection and study of these forms, and in 1888 published a short paper relating thereto in the journal of this society. On his return from a long sojourn in Europe in 1887 Mr. Thomas Wilson took the subject up afresh, and has since published short papers upon the general subject of palæolithic man in America, in which allusion is made to the local finds. The most direct and thorough treatment of the subject occurred at a meeting of the Anthropological Society held in the month of April, 1889. In the symposial discussion of the archæology of the District of Columbia, three papers, by W J McGee, Thomas Wilson, and S. V. Proudfit, respectively, bore directly upon these rude objects ; but up to the present time no one has essayed more than to study the surface finds, and therefore comparatively little was known of the true character and history of the chipped implements of the region.

SURFACE DISTRIBUTION OF RELICS.

The objects in question are somewhat sparingly scattered over the surface of the country, and are found to some extent upon ancient village sites along the Potomac and its tributaries ; but the main deposits, as shown by recent discoveries, occur along the steep faces of the great terraces that surround the city. To these spots the ancient inhabitants resorted to collect the cobble-stones there outcropping and to chip them into desired shapes, and it is to these sites—the ancient workshops—that we must look for light to illumine some of the obscure features of archæologic science.

BEGINNING OF THE WORK.

In July, 1889, at the instance of the Director of the Geological Survey, I resigned my place in that organization to accept a place as archæologist, under the same direction, in the Bureau of Ethnology. It was intended that in the near future I should begin archæological investigations along the Atlantic coast, and I resolved to commence work at home—literally at home—for the nearest site in which these rude implements are found, and one of the most promising sites for archæologic research in the United States, was only one and a quarter miles from my own doorstep in this city.

But, aside from the convenience of the locality, there were other good reasons for beginning the work here. The relics found have a direct bearing upon questions of the early occupation of this country—an occupation believed by many to have preceded that of the Indian. These questions are of the utmost importance and demand the fullest and closest attention, since their study necessarily precedes and introduces the discussion of the general archæology of the Atlantic slope; but, further, these deposits of artificial refuse being of great extent and of unknown depth, the undertaking, to be carried out systematically and thoroughly, involved very considerable expense and seemed beyond the reach of private means.

The site chosen is representative of a class, and will serve in a measure as a key to all. Other localities may present different phenomena and possibly conflicting testimony, and their examination may lead to changes in some of the conclusions drawn from the study of this example; but the lessons here taught are for the most part complete in themselves, and the work as a whole will constitute a nucleus of well-ascertained fact, about which other units of like character will gradually accumulate. The work derives its chief importance from the fact that it is the first exploration in this section of a well-identified quarry workshop of the ancient flaked-stone tool-makers.

LOCALITY.

In passing out of the city by way of Fourteenth street extended, a picturesquely located bridge is crossed at a point one and a third miles from Boundary street. The little stream spanned by this bridge is known as Piny Branch and falls into Rock creek at a little more than half a mile below the bridge.

Arrived at the bridge, we are already within the limits of the im-

plement-bearing area, and the rude objects may be picked up on all sides—in the lanes that lead up through the forest-skirted farm of Mr. Blagden, in the beds of all the streams, and upon all the slopes north and south of the creek, including an area three-fourths of a mile square.

In this investigation we are particularly concerned in a portion of the area on the north side of the creek and just west of the Fourteenth-street road. Here the faces of the plateau rise to 100 feet above the creek bed and 200 feet above tide-water. The slopes are precipitous, but generally even and regular, and are covered with forest, much of which is primeval. A number of small rivulets descend from the plateau through deep ravines into the creek. One of these, coming down from the north, is seen by the road-side at the left, and another, quite obscured from any ordinary point of view by the forest, occurs one-fourth of a mile to the west. Between these two ravines is a promontory or spur of the plateau with a nearly level top 100 yards in width, the steep slopes of which descend to the rivulets on the east and west and to the creek on the south.

Upon these steep slopes the primitive peoples found the material used in implement making, and here they worked, until a mass of refuse of astonishing magnitude had accumulated. This is now found not only upon the slopes, but in the masses of gravel at the base of the slopes and in the flood planes of the valley, even down to Rock creek and for an unknown distance along its course.

DISCOVERY OF SHOP SITES.

Mr. S. V. Proudfit has in past years explored this locality with considerable care, and in the *ANTHROPOLOGIST* of July, 1889, he describes the distribution and character of the relics with accuracy and in some detail.

So far as known, the first discovery of worked stones upon the site of my excavations was made by Mr. De Lancey Gill, who was engaged in sketching upon the bank of the Branch, and by chance observed an implement in the gravel at his feet. Subsequently he came upon a number of heaps of shop refuse in the western ravine at the point now cut by my section.

In September, 1889, I visited Mr. Blagden, owner of the property, to obtain permission to work upon the premises, and learned from him that about the year 1878 a street contractor had been

permitted to collect material for paving from these grounds, and that the piles of refuse found by us were gathered together at that time, a portion only of the heaps collected having been carted away. At that time a narrow roadway was cut leading from the creek up the little ravine to the site of our recent labors. Mr. Blagden subsequently informed me that when yet a boy, some twenty-five years ago, he had observed the great quantities of bowlders at this point, and, desiring to know something of the reasons for their accumulation, had secured help to dig a trench, which was abandoned, however, before the bed of boulder refuse was penetrated. I have no doubt that the evidences of former excavation discovered at the fiftieth foot of my section, and which caused me no little perplexity at the time, is thus fully explained.

SURFACE INDICATIONS OF QUARRY SITES.

In beginning the examination of this site my first step was to observe carefully its topographic features, with especial reference to such eccentricities of contour as might be due to the agency of man.

Extensive working over of *débris*, especially if associated with quarrying, would leave inequalities of surface which, if not afterwards obliterated or greatly reduced by natural forces, would be easily recognized as artificial. Such inequalities were readily found, and so well defined are they that even the casual observer could not fail to detect them. It was partly on account of peculiarities of profile that excavations were undertaken at the spot selected, and the results have shown that these surface indications were not deceptive.

The higher up the gulch we go the more pronounced are the elevations and depressions resulting from the ancient work. Either the disturbances here are more recent than below or the leveling agencies of nature have been less active.

THE EXCAVATION.

I shall not attempt in this place to give a detailed account of the geologic formations of the region, nor shall I refer to the methods of exploration and the interesting but tedious details of excavation. A brief review of those members of the geologic section most intimately associated with the work of man will be sufficient for present purposes, and the diagram here presented, Plate I, will assist in making all my statements clear. The three formations involved are,

first, the mica schists, A, which underlie the whole region and form the bed-rock of the Piny Branch bluff up to within perhaps forty feet of the summit. Second, the sedimentary gravels, sands, clays, and boulder beds, B, lying horizontally upon the schists and forming the bed-rock of the upper forty feet of the slopes. These belong to the Potomac formation of Mr. McGee and are of Mesozoic age. Third, the over-placed cloak of soil and gravel, C, derived from the above fundamental formations and completely covering them. It is with these latter beds that the student of human history is chiefly concerned. At the point cut by the section these gravels are separable into three important but not always clearly definable groups, which may be designated as follows: 1st, the pre-artificial, C¹; 2d, the artificial and inter-artificial, C²; 3d, the post-artificial, C³.

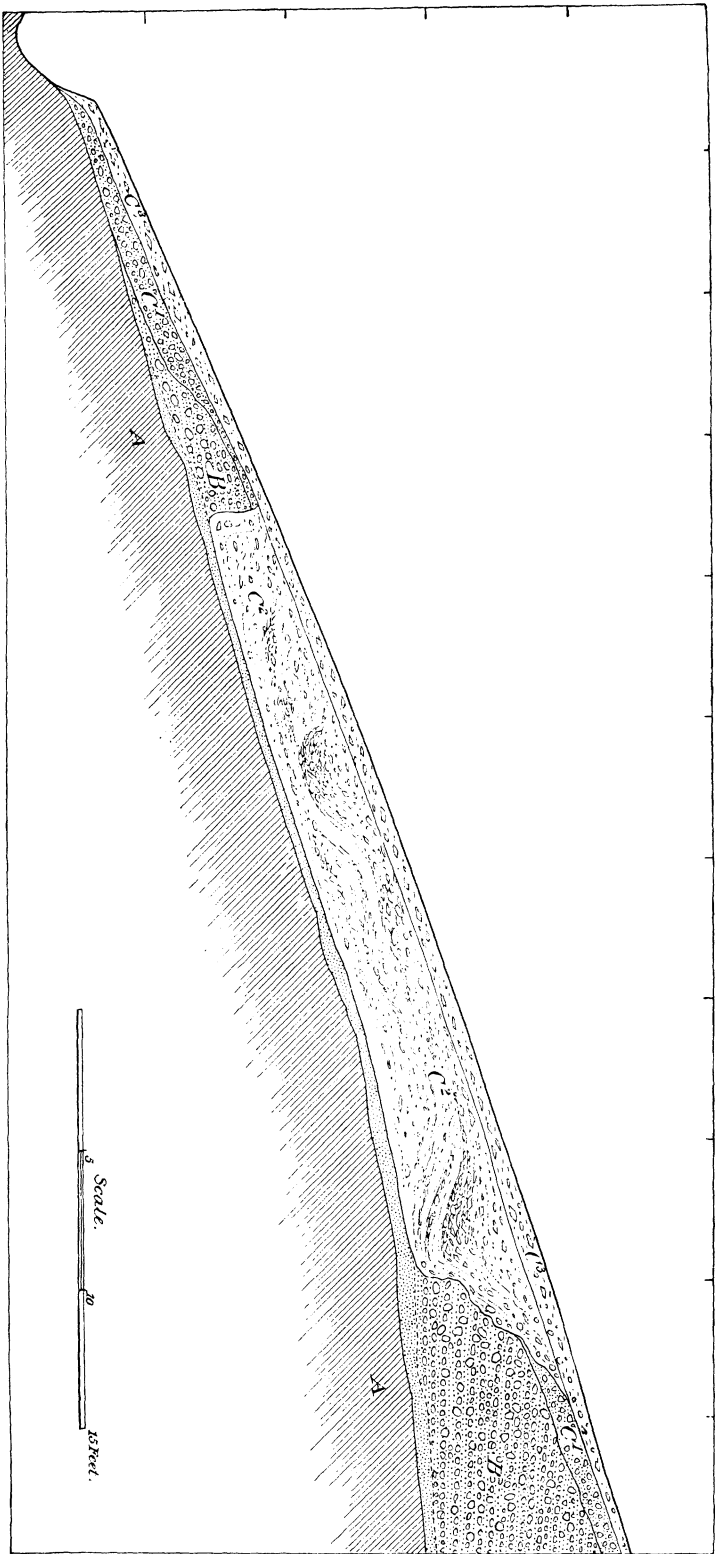
The pre-artificial gravels, C¹, consist of détritns derived from the outcropping edges of the underlying formations and spread over the surface before this site was occupied. These are therefore free from artificial remains.

The artificial deposits, C², consist of beds and masses of débris obtained from surface gravels and from the Potomac beds beneath by men quarrying for boulders, the raw material used in the manufacture of stone implements. These masses of refuse, worked over and rearranged by the hand of man, alternate in a rude way with layers of material that appear to have been redistributed to a certain extent by natural forces during intervals separating seasons or periods of human activity.

The post-artificial deposits, C³, consist of surface detritus rearranged by natural forces anterior to the period of human occupation, and consist of gravel, loam, shop refuse, and vegetable mold. They form but a thin sheet, save in the flood plain of the rivulet, where they have accumulated in places to eight or ten feet in thickness. They contain numerous relics from the workshops throughout the large area examined, and upon the middle part of the slope cut by my section the relics and shop refuse are amazingly prevalent, forming, perhaps, one-fourth of the entire mass.

Now at the point cut by this section small portions only of the pre-artificial-slope gravels remain in their normal condition. The principal parts remaining are near the lower and upper ends of the cutting, where the ancient workman left them undisturbed. Other small portions probably remain upon the uneven edges of the schists

PLATE I.—Section of quarry workshop as exposed by excavation. *A*. Mica Schists. *B*. Potomac (Mesozoic) Boulder beds. *C*1. Pre-artificial slope gravels. *C*2. Deposits of shop refuse showing traces of pits. *C*3. Materials rearranged by natural forces since the period of quarrying.



and upon the mesozoic beds at points where the cobble-diggers did not wholly penetrate them. We have no means of determining with precision the original thickness of this deposit at points where artificial disturbance has taken place. The condition of the remnants above and below indicate that the surface, when man first appeared to gather cobbles, was not greatly different from that of the present day. Additional reasons for this conclusion may be given: First, there can have been little reduction of the mass of the hill, because the artificial formations remain upon the slope, and that so completely that evidences of heaping up and excavation are not wholly obliterated; and, second, there is no possible way of elevating the profile by natural means, since there is but a meager mass of material above to draw from; besides, if filling had occurred, the artificial profile would have been obliterated as surely as by degradation.

Adopting the assumption, therefore, that the profile of the hill and the general relations of the principal members, A, B, C, of the section were the same when man first appeared as they are now, let us briefly note the work accomplished by his hands: Throughout all the unnumbered years that have elapsed since this little valley was definitely outlined, the formations of the upper slopes, including the boulder beds, have been disintegrating and sliding or rolling down toward the rivulet. My examination has shown that the boulders lodged in numbers at all levels, and thus became imbedded in the slope gravels; but it is probable that the boulders were more numerous than elsewhere below and near the immediate base of the outcrop from which they were derived—that is to say, about midway in the slope. Howsoever this may be, it now appears that the boulder-hunter has worked over this part of the slope, and that millions of worked stones and unshaped fragments now occupy the site.

In cutting the section from below, the first positive evidence of ancient excavation was encountered at about the twenty-fifth foot, and from this to the fortieth foot this work had reached five feet in depth beneath the present surface. At the fiftieth foot it had reached five and one-half feet, and at the sixtieth foot it was six feet deep and had penetrated the gravels and the Potomac beds beneath to within one foot of the underlying mica schist. At the seventieth foot the overlying formations had been entirely penetrated, and the ancient workman stood upon the mica schist, nine feet below the surface, and there shaped his rude stone tools. At the seventy-ninth foot

we encountered the face of the Potomac boulder bed, an uneven wall some ten feet in height, composed of ovoid quartzite boulders, many of which are wonderfully adapted to the hand of the stone-age tool-maker. They are firmly imbedded in a matrix of argillaceous sand. Here was the quarry face of the ancient miner. Facing a wall like this, he was in a position to supply the whole ancient world with the raw material for one of its most important arts.

Now the analysis of the phenomena here encountered has been made with the utmost care, and I have called upon our foremost scientists to witness every feature of interest.* First in importance are the evidences of deep quarrying. In the vertical walls of our excavation the sloping sides of the ancient pits are clearly defined by layers of differently colored earths, and the beds and masses of refuse from the workman's hands are not changed in their relations and hardly changed in their appearance since the day they were deposited. Masses of shop refuse were encountered at every step of the excavation and had the appearance of pockets, as shown in the section, Plate II, which represents the front wall of the trench at the seventy-fifth foot.

The lower pocket of refuse shown in this section was eight feet below the surface and rested almost upon the surface of the schists. It had been thrown against one side of the pit-bottom, and was upward of two feet in depth. It consisted of boulders, whole and broken, and fragments in all stages of manufacture, including numerous well-shaped forms and many chips.

A remarkable feature of this pocket of shop refuse was the openness of its interspaces. Animals as large as rats could have entered the openings and meandered the subterranean passages with ease. This feature is well shown in Plate III. Upon this loose heap of debris irregular layers of earth and gravel containing a few boulders were superimposed, and upon these again another bed of artificial refuse, of great extent and thickness, had been thrown. The position and nature of this bed is shown in the middle part of the section. Here both rude and well-shaped relics of art were very numerous, and flakes and fragments were innumerable. The walls of the pit in which they accumulated are clearly defined to a height of six feet.

* Mr. W J McGee took exceptional interest in the work and his advice and assistance have been of the greatest service. It is gratifying to be assured of his concurrence in my conclusions regarding the quarries and quarry products.

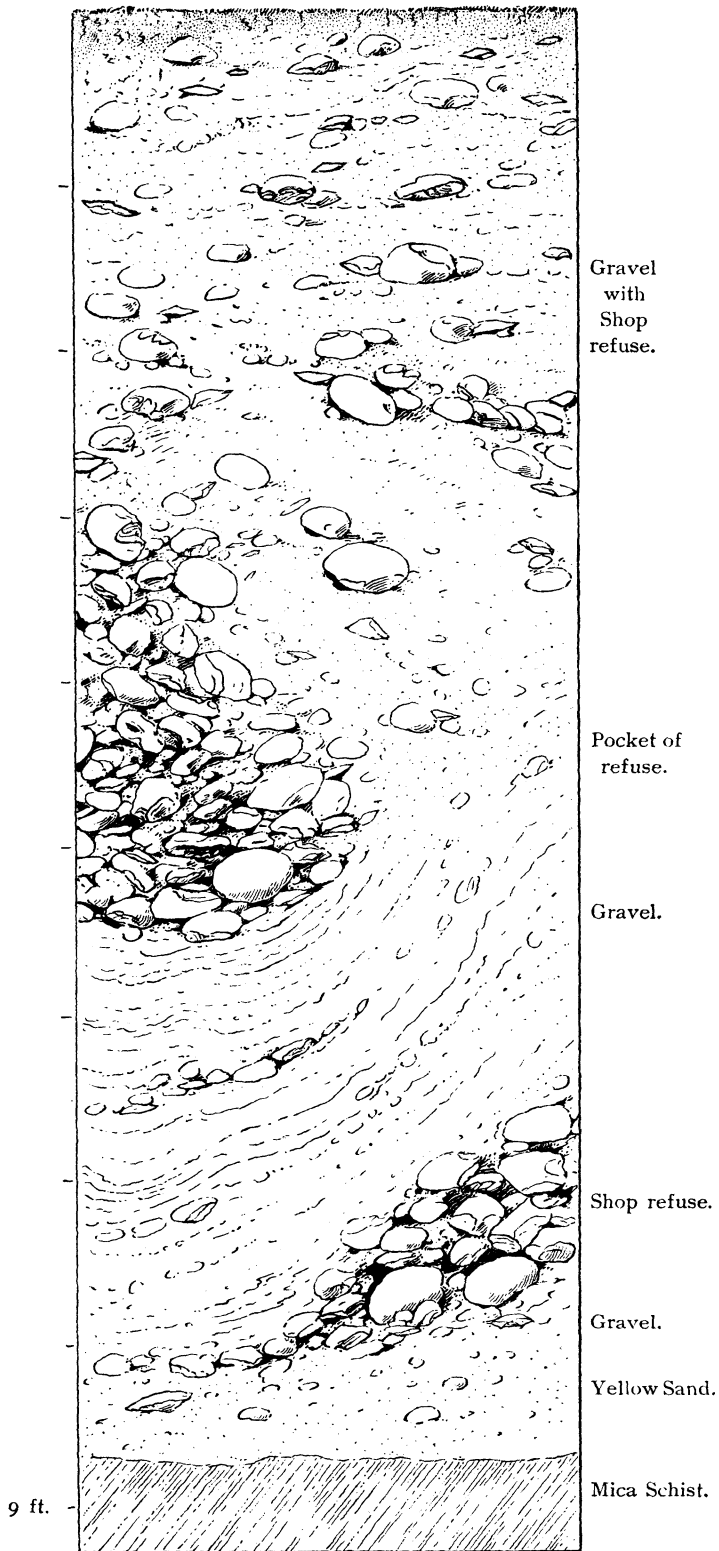


PLATE II.—Front wall of excavation at 77th foot, showing pockets of shop refuse.

Over this and extending to the surface are two or three feet of heterogenous deposits, consisting of coarse and fine gravels well stocked with all forms of artificial refuse. The upper part of these beds belongs to what I have called the post-artificial deposits as apparently they have been rearranged by natural means. The line separating the distinctly artificial from the rearranged or natural is too indefinite to be fully made out. It is generally not far from the bottom of the vegetable mold, which varies from two to fifteen inches in thickness, save where pits existed at the time of abandonment, where it is necessarily deeper.

The magnitude of the work accomplished by the ancient miners will be realized when it is stated that my trench crossed a belt of worked material fifty-five feet wide and, on an average, upwards of six feet deep, and that this belt extends horizontally along the bluff for an unknown distance. Judging by surface indications, it may extend half a mile or more.

The work of excavation does not seem to have begun at the lower edge of the worked belt next the stream and to have been carried up the slope and against the face of the boulder outcrop, but to have been carried along the slope from right to left, the gravel having been worked backward and downward as the pits advanced, filling up, to a great extent, the earlier excavations.

As to the ancient methods of excavating the pits and moving the material we have learned but little. No remnants or trace of tools have been found. Wooden utensils, such as a primitive people might devise, would have served to loosen the boulders and remove the earth and refuse. Stone tools would hardly have been employed, as it would be folly to jeopardize finished stone implements in the rough work of quarrying and fracturing boulders.

The conditions seen at this point and recorded in the sections are representative of the whole site, so far as examined, and I need not here go into greater detail.

ART PRODUCTS.

We pass naturally from a study of the general features and phenomena of the factory site to an examination of the articles manufactured—to a consideration of the origin, development, and destiny of the stone implements produced. I wish here to call especial attention to the fact that perhaps never before has such an opportunity to study these latter points been presented to an American archæ-

ologist. Heretofore we have been called upon to lament both the meagerness of our material and the incomplete character of the evidence concerning it. In the present case there is an abundance of material and a completeness and clearness of evidence that leaves nothing to be desired.

From a trench three feet wide and fifty feet long cut through the artificial deposits of this slope I have obtained nearly two thousand worked stones, all exhibiting design, and have examined a thousand cubic feet of material, all or nearly all of which had been worked over by the ancient quarryman, and fully one-tenth of which consisted of artificial fragments.

If other parts of this promontory face are as well supplied with artificial products as this one—and the indications are that such is the case—we can safely estimate that the site contains over a million finished, unfinished, and broken implements.

Of almost equal importance is the fact that this is an undisturbed quarry workshop which contains in one form or another multitudes of examples of each and every form made, as well as all the tools used in the making, and as it is not on a village site, and probably far from one, it is wholly free from domestic refuse and from all other exotic products.

The unexampled simplicity of the conditions is further emphasized by the fact that but one material—and that in one form—was used, and still more, that but one kind of machinery and one process were employed in all this great factory; and, furthermore, I may add, in advance of proofs which are forthcoming, there was but one period of work, and that by one race, whose clever artists had in mind, so far as this shop was concerned, but one ideal. The value and importance of this simplicity of condition will become more and more apparent as we advance in the investigation.

The material quarried and used was quartzite, a flinty sandstone. It was in the form of small ovoid boulders worn down by the action of water. These boulders were worked into desired shapes by the artist, and the tools he had to work with were also boulders identical in every way with those worked; and of prime importance in this discussion is the additional fact that the process employed was exclusively fracture by free-hand percussion, the act being a quick, firm stroke, regulated in force by the nature of the resistance to be overcome and by the result desired. I have found absolutely no trace of other kind of procedure.

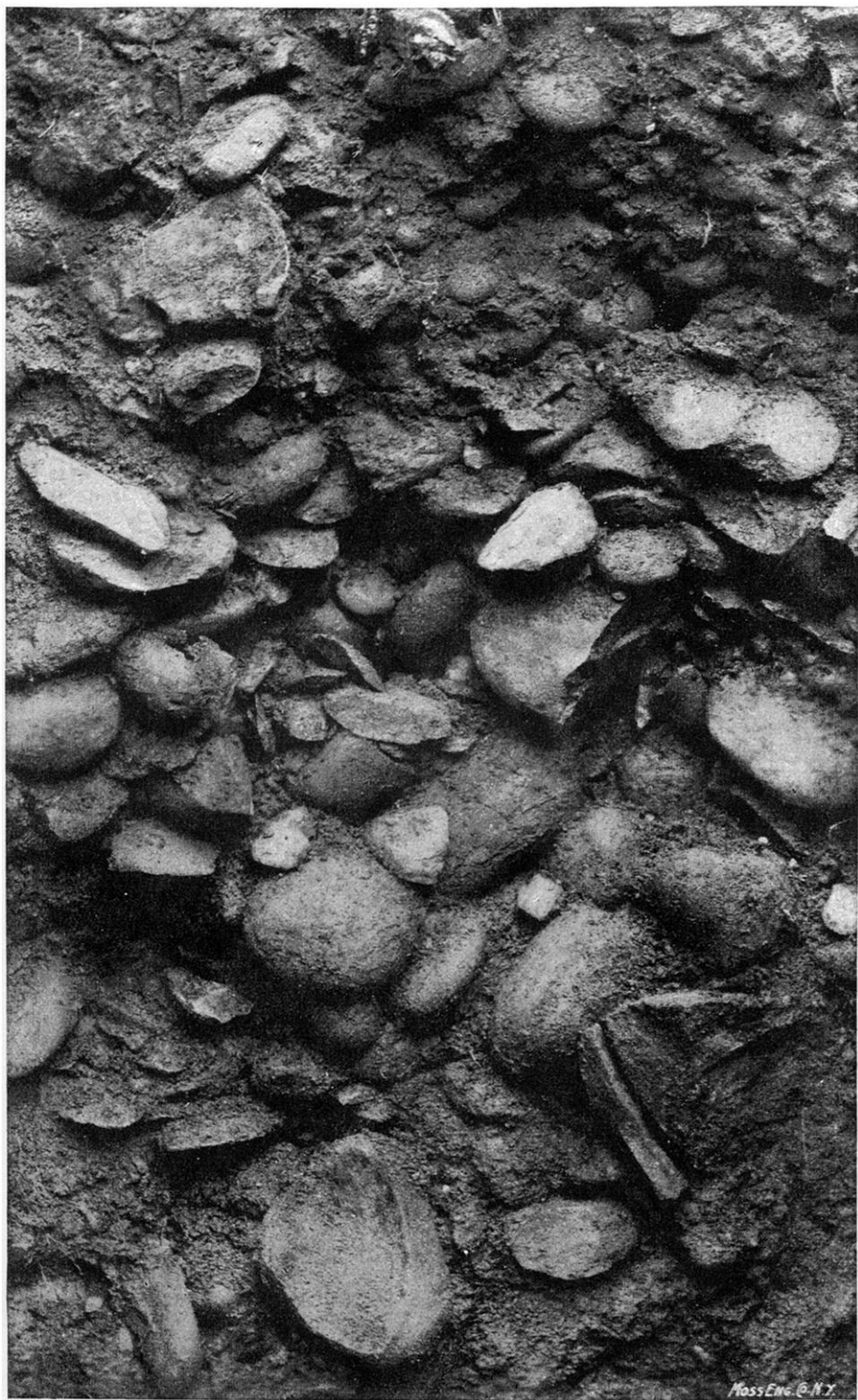


PLATE III.—Portion of front wall of excavation at the 44th foot. Upper line of picture $2\frac{1}{2}$ feet below surface of ground. Scale about $\frac{1}{4}$ nature. The shop refuse is seen to be uncompacted and open and a number of failures and fragments of unfinished tools are in sight.

The bold but unsymmetric outline of the tool, the haphazard arrangement of the strokes, and the width and irregularity of the flakes unite to preclude the idea that any process capable of adjusting the point of contact between the tool used and the article shaped could have been employed.

The first step in the classification and study of these implements, finished and unfinished, is to separate them carefully from the refuse. The line must be drawn, not between specimens showing evidences of work and those showing no evidence of work—for if this were done we would have to discuss a hundred tons of material—but between relics that bear evidence of design and those which do not. Many broken stones and flaked fragments and all chips show indisputable evidence of work, but their shape is not the result of design. A case in point is the stone from which flakes have been taken to be themselves shaped into tools. Such a stone, usually called a core, has a faceted appearance, suggesting design, but in itself it is not the result of design. Again, a flake or fragment broken from a tool already worked over will retain upon its outer surface a number of the facets of that tool, and thus to the careless observer it bears the appearance of having been itself subjected to the shaping process.

With these distinctions in mind, the archæologist has but little trouble in recognizing and separating all classes of products, and the uninitiated with a little careful study may readily learn to do the same.

Having handled the products of this shop constantly for a period of several weeks, I have familiarized myself with every variety of form and shade of contour, and do not feel the least hesitation in presenting the results of my selection and classification.

In Plate IV is presented a series of worked stones taken from this site, which represents every variety of product and epitomizes the entire range of form. Beginning with the boulder *a*, from which two chips have been taken, we pass through successive degrees of elaboration, reaching final forms in *k*, *l*, *m*, long leaf-shaped blades. Profiles of the type specimens are placed at the right. These illustrations are one-half actual size and are far from satisfactory, as it is extremely difficult to secure good photographs of objects whose prevailing colors are greenish and brownish grays.

If it be asked how I know that this series is complete, I answer that quartzite, the material used, although so firm and indestructible,

is at the same time brittle. It is impossible to shape from it flaked tools, howsoever simple, and succeed in every case. Some—I may safely say many—are necessarily broken, and the discarded remnants tell the story. A careful study of every shade of form shows that more are broken than remain in the workshop entire, and I may add that had every entire flaked tool been taken from the spot the record would remain, and with a certainty that is absolute.

Referring again to this series, we see that the process of manufacture and the steps of development are essentially as follows:

Grasping a boulder in either hand, the first step was to strike the edge of one against that of the other at the proper angle to detach a flake. The second step and the third were the same, and so on until the circuit was completed. If no false step was made and the stone had the right fracture, these few strokes, occupying but as many seconds, gave as a result a typical turtle-back—a boulder with one side faceted by artificial flaking—the other side, save through accident, remaining smooth. If the removal of a single row of flakes was not satisfactory, the work was continued until the availability of the stone for further elaboration was properly tested. This completed the first stage of the manipulation. A type profile is illustrated in *n*.

If the results thus far were satisfactory the stone was turned in the hand, and by a second series of blows the remaining smooth side was flaked away, and the result was a two-faced stone or double turtle-back. With, perhaps, a few additional strong strokes the rough stone began to assume the outlines of the final form, and the second stage was soon completed, a type profile being seen in *o*. If at this stage, and I may say if at any preceding stage, the stone developed defects or unmanageable features—such as too great thickness, crookedness, or humps that could not be removed—it was thrown away and thus became part of the refuse; and it would appear that all the entire specimens collected belonging to these two stages, since they were taken by us from the refuse, did develop some of these failings, and the same may be said of their 500,000 brothers and sisters.

If, however, the form developed properly, the work was continued into what I have called for convenience the third stage. It consisted in going over both sides a second and perhaps a third time, securing, by the use of small hammers and by deft and careful blows upon the edges, a rude but symmetrical blade. A profile is given

NOTES ON PLATE IV.

In this plate is presented a series of forms epitomizing the quarry workshop rejects and indicative of successive steps in the manufacture of implements. The scale is about one-half nature. Flakes and other fragments not exhibiting design are excluded.

a. Boulder with two flakes removed; probably rejected because of coarse grain and difficult fracture. This boulder, which is four and one-half inches long, three and one-half inches wide, and nearly two inches thick, is of typical shape and of nearly average size. The largest worked specimens are about one foot in length and the smallest not above an inch. Such extremes are rare.

b, c, d. Specimens worked on one side only and probably rejected on account of perverse fracture or excessive thickness. A profile is shown in *n*.

e. A few flakes removed from the back; fracture perverse.

f, g. Carefully worked on both sides, but still excessively thick, hence the rejection.

h. Broken by a stroke intended to remove a prominent hump. Profile shown in *o*.

i. Neat in shape but with a high ridge or hump on the back which many strokes have failed to remove. This piece could as well be classed with the second group as there is no very definite line between it and the third group.

j. Unsymmetric broken blade.

k, l, m. Thin, neat, broken blades. These must have been very near completion, so far as free hand percussion was concerned, as they are neatly flaked over the whole surface and are quite attenuated. That they were unfinished is indicated by the fact that they were broken while still under treatment. Their thickness is indicated in *p*.

To the first and second stages of manufacture belong many very rude, irregular, and broken forms that could not be represented in this series.

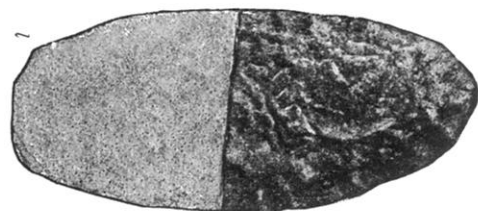
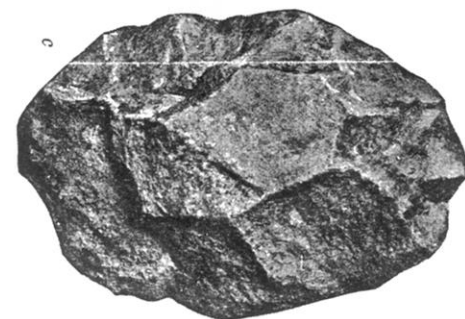
The last specimen of the series, *m*, is perhaps the most advanced form found, but that it was not finished is clear not only from the fact that it was broken by a strong blow while still under treatment but from the unfinished character of the point and portions of the edge.

It is highly improbable that we have in the whole series of products of the quarry, here epitomized, any finished tool, either whole or represented by fragments. This should not be regarded as an opinion merely; it is a conclusion based upon evidence that cannot be lightly treated by the scientific investigator.

3d Stage—Both sides re-worked.

2d Stage—Both sides worked.

1st Stage—One side worked.



in *p*. If, even at this stage of advancement, it was vitally defective, it was either broken in the attempt to correct the defect or was thrown into the heap as useless.

Four broken specimens that approach very closely the quarry-shop ideal are shown in *j*, *k*, *l*, and *m*. No good example of this class was found entire, and illustrations had to be selected from the broken specimens, both halves of which happened to be recovered, or from single halves. In nearly all cases such specimens have a broad end and a pointed one, and these features were generally foreshadowed in the first stages of manufacture, and were kept in view throughout the progress of the work. These blades vary from two to five inches in length, and are generally under two inches in width and less than one-half an inch in thickness. It was requisite that they should be straight and symmetrical, and that the edges should have a bevel as slight as consistent with needful strength. Only one piece was found that had been carried beyond this stage, a rude stem having been worked out at the broad end. This specimen was found near the surface. Two other pieces, found at considerable depths, exhibit slight indications of specialization of form, which, however, might have been accidental.

And now, having followed the process to the end, I wish to call especial attention to the fact, if my view be correct, that when this thin blade was realized the work of this shop and the only work of this shop, so far as shaping is concerned, was ended. The process and the machinery had accomplished all that was asked of them and all that they were capable of accomplishing. The neat, but withal rude, blades, and they only, were carried away, and that to destinies that we may yet reveal. Further work, additional shaping, if such there was, employed other processes and was carried on in other fields.

The course of procedure just described I have investigated in the most careful manner, and by experiment have followed every step of the process, and have achieved almost every result. I have found that in reaching one final form I have left many failures by the way, and that these failures duplicate, and in proper proportions, all the forms found upon the site.

I further find by these experiments, and the fact is a most important one, that every implement resembling the final form here described made from a boulder or similar bit of rock must pass through the same or much the same stages of development, whether shaped

to-day, yesterday, or a million years ago; whether in the hands of the civilized, the barbarian, or the savage man.

Now with these facts clearly in mind, it seems almost superfluous to expend additional words in showing that all forms found in the workshop other than the thin blades accidentally lost are mere waste; but in a matter having so important a bearing upon the very foundations of our study of primitive archæology no point should seem to be slighted.

It causes me almost a pang of regret at having been forced to the conclusion that the familiar turtle-back or one-faced stone, the double turtle-back or two-faced stone, together with all similar rude shapes, must, so far as this site is concerned, be dropped wholly and forever from the category of implements.

Our utmost effort cannot wring from them a fact or a suggestion of value upon any of the great questions of time, race, and culture, and it follows that what is true of the rude forms of this particular locality may be true also of all similar forms found throughout the Potomac valley.

But why should we regret such a conclusion? If the simple-minded savage, who laboriously quarried and shaped these forms, cast them at once and without hesitation into the refuse literally, there can be no sound reason why we, as searchers after truth, should hesitate to do the same thing scientifically.

I have obtained from this one small spot, less than twenty square yards in area, fully 1,000 turtle-backs of the two forms—a greater number than has been collected heretofore in the whole Potomac province. And why? There can be but one answer. This spot is a great workshop where tools were shaped or, rather, roughed out, and these things are the failures. The soundness of this view is further proved by the fact that these forms are not found carefully deposited in clusters or caches, but are distributed with considerable uniformity throughout the mass of refuse from top to bottom and from end to end.

But there is additional confirmatory evidence. I have prepared a statement by means of which some important facts will be made apparent. In this case the great importance of having at hand a large and exhaustive series of the art products of a veritable workshop becomes apparent.

As already seen (see Plate IV), I have divided the shaped forms into three classes, which are separable by well-marked steps or stages

of manufacture. In the series here presented four are of the first stage, four are of the second stage, and the remainder of the third stage. It is not convenient to divide the series differently or more frequently.

The relative numbers of these three classes found within the trench are given below. Halves in each case are recorded, as they serve to point out an important fact.

Of the first stage there are 380 whole specimens and 460 halves.

Of the second stage, 250 whole specimens and 320 halves.

Of the third stage, 12 whole specimens and 380 halves.

It will be noted that of the whole specimens of the third stage there are but twelve representatives, and I may add that these are comparatively rude, and with two or three exceptions can as well be classed with those of the preceding stage. Practically, therefore, there were no examples of the successful quarry products left upon the ground. All forms available for further shaping or for immediate use, as the case may be, were carried away as being the entire product of the shop, the only reward for the long-continued and arduous labor involved in their production.

Now these three stages do not necessarily represent the full scope of the art of the ancient tool-maker, and in this connection it is of the greatest importance that we should keep in mind the fact that this site is only a quarry workshop, which was naturally not a place for finishing tools, but one for roughing out the material and selecting that fitted to be carried away for final finishing. A laborer engaged in such work in a pit in the forest would not be likely to throw aside the rough hammer used in fracturing cobbles to take up and operate an entirely different kind of machinery, involving a distinct and delicate process. Being a reasoning and practical creature, he would carry away the roughed-out tools, the long, thin blades, to be finished at his leisure and by whatsoever method custom had placed at his disposal.

It may be well just here to define with some care the apparent limitations of the classes of procedure concerned in the manufacture of flaked tools.

Direct or free-hand percussion is the natural method of reducing large amorphous masses to something approximating the special shapes reached in the advanced stages of the art. It was probably the only method known in very early times; but this process, even in the most skillful hands, has its limitations in certain directions. For

example, blows cannot be given with sufficient regularity to secure great symmetry of outline and, uniformity of flaking; and, again, when implements under treatment become attenuated the sharp blow is extremely liable to shatter them. The skill of the artificers being equal, these limitations vary with the degree of brittleness and homogeneity of the material used.

In the case of quartzite, free-hand percussion cannot accomplish more than the merest roughing out, as the material is extremely fractious; but it is equally true that by more refined methods as great or even greater difficulty in shaping this material would be encountered, and the skill of the workman must have been tried to the utmost to carry the manufacture by the first process to a stage where the other methods would be operative. It is probable that some method employing indirect percussion may have followed that of direct percussion. By indirect percussion I mean the use of two tools, one the hammer and the other the punch, the latter being set upon the exact spot to be fractured, thus eliminating the element of uncertainty characteristic of the free-hand blow, although at the same time losing a large part of the percussive power.

By the latter method, if not by the first, the rude quarry blades could be carried to a degree of symmetry and attenuation that would enable the artist to employ to advantage a bit of notched bone or a like device, and thus to carry the tool to the highest possible degree of specialization and finish.

At any rate, it is clear that the quarry forms bear no evidence whatever of that regularity and refinement of flaking and that neatness and symmetry of form that characterize results by these latter methods,

And now what of the probable destiny of the quartzite blades that, as we have seen, were graduated from the school of direct or free-hand percussion? Am I correct in the assumption previously made that they were carried elsewhere to be finished by more gentle methods of manipulation, or were they already finished and ready to go into the service of their rude owners?

There is a wide-spread impression that quartzite tools related to this quarry form are not found upon village sites in this vicinity, and that they are not generally distributed over the hills and valleys; but I find upon examination that this assumption is entirely without foundation, and that not only this form, but all others ranging from it down through the specialized and minute forms, occur in many places and in great numbers.

But I must add that to a limited extent the rude forms—the turtle-back and its near relatives—are also found widely scattered over the Potomac valley outside of the shops in the hills. This would seem to conflict with my former statement that all of these rude shapes are failures and were left upon the factory sites.

It is time, therefore, that I should define a stone-age workshop. It is any spot where an individual desiring to make an implement picks up one or more bowlders or bits of stone and proceeds to shape what he desires. It is a shop just the same if thousands of rocks and hundreds of men are concerned. It is a quarry workshop if the raw material is secured by means of excavation or is broken from masses of rock before the shaping begins.

Bowlders and bits of workable rock, singly or in numbers, are scattered over the face of the country—on the beach, on the river banks, in the woods, in the green fields, and on village sites. If rude, unfinished forms are not found on some village sites it is very probably because material suitable to be worked was not found upon the spot. I venture to surmise that upon extensive areas of alluvial land where the raw material is very scarce the rude forms of tools will be exceedingly rare, although all post-quarry and final products abound.

In this part of the valley shop sites are very numerous, and wherever they occur will be found relics representing the stages of manufacture—turtle-backs, double turtle-backs, and failures of every shape and kind, depending for their character upon the species and form of rock, the skill of the workmen, and the kind of tool designed; but in any case ordinary percussion was concerned in only the rougher work, and indirect percussion or pressure was employed in the final stages. The thick, clumsy forms are in every case mere refuse. There is so far no evidence that any inhabitant of the Potomac valley ever aimed to make by flaking alone any other than the attenuated forms, one-half an inch or less in thickness, such as we see in knives, scrapers, spear and arrow heads, perforators, and the like. Very rude forms may occasionally have been used in emergencies, or even may have been shaped for special uses of a local or temporary kind, such as quarrying soapstone or girdling trees; but the quarry forms here found were certainly not made to be used, and we have additional confirmation of this in the fact that it is exceptional to find examples of the class that show evidence of use, or even that were found in such situations as to indicate that they had either been used or valued.

A very large percentage of the chipped-stone forms found in our museums, and over which endless discussions have taken place, are only failures gathered from shop sites; while many others from shop sites and elsewhere are unfinished implements lost or thrown away before the final shape was reached. It was impossible to make these distinctions with accuracy until a veritable fossil shop-site, dissociated from other finds, was discovered and systematically explored. It may be said with much truth that the archæologist who studies flaked stones of any country without having made himself familiar with the functions and character of such a workshop is liable to make most serious blunders.

As a corollary of the determination of the true quarry product we arrive at the definition of a cache. The ordinary cache of stone implements is a cluster or hoard, numbering, perhaps, a score or more, which has been secreted or deposited in the earth by the owner, and who for some reason never exhumed it. Such hoards are frequently discovered by workmen in the fields.

Having reached a definite conclusion that the blades were the exclusive worked product of the quarry, I was led to investigate their subsequent history. The working of a quarry such as I have described led inevitably to the production of blades in numbers, and it follows that they were removed in numbers, since the supply for the entire year was to be obtained probably within a small fraction of a year, the working period being determined by the season, by tribal movements, or by other limitations of time.

In speculating upon the probable nature of the transportation, storage, and distribution of such quarry forms I happened to observe that they were identical in character with the objects usually contained in caches, and the conclusion was at once suggested that all such cache forms are quarry products—unfinished tools—varying in character with the material, the process, and the habits or needs of the people concerned; that they had been roughed out in numbers and to a stage of advancement that made them portable and at the same time placed them fully within the reach of the processes to be employed in finishing, and that they had been carried away to the villages and buried in damp earth, that they might not become hard and brittle before the time came for flaking them into the final forms required in the arts. The story begun in the quarry is thus expanded and the status of the cache tentatively determined.

The history of the quarry forms is not completed, however, until

we have noted their final distribution among the individuals of the various tribes, until we have witnessed the final step in the shaping process—the flaking out of specific forms with a tool of bone—and their final adaptation to use and dispersal over the country.

And now, hastening over this interesting field, the problem of age and race, so far as the results of this exploration relate to them, must be hurriedly examined.

AGE AND RACE.

The question of the antiquity of the period of occupation is one of paramount interest and importance. When it is fully and finally answered we shall no longer be uncertain as to whether our researches refer to a well-known people or to a race shrouded in a thick veil of mystery.

If the attainable evidence is against great age, or even if it is not decidedly in favor of great age, the natural conclusion is, or ought to be, that the race concerned is the Indian; for he is well known to us as an actual occupant of the region, and the period of his occupancy, while coming down to our time, and therefore recent, is not at all well defined in respect to the other limit. If, on the contrary, the evidence favors great age—if the latest limit of the period of occupation is remote and apparently far antedates the period of which we have historic knowledge—we shall not perhaps be warranted in identifying the ancient quarry-worker with the Indian, and ultimately may even find it necessary to refer him to another and earlier stage of culture.

Unfortunately we have in the Potomac valley but meager and imperfect indices of age. Geology, the great time gauge, is not known to have made a definite record since the first glacial epoch, a period antedating traces of man, and therefore important proofs of a geologic nature bearing upon this question do not exist, and answers to questions concerning remote chronology must be sought elsewhere. There are some minor records, however, pertaining to geology which are worthy of careful study.

The art relics from the site examined are, as we have seen, more or less intimately associated with three formations. Two are old, antedating the advent of man, and the other is now in process of accumulation and alteration under conditions that have been practically the same ever since glacial times. These associations, therefore, of themselves afford no assistance whatever.

An examination of the quarry-shop refuse makes it apparent that the period of occupation was very long. The accumulations of worked material are of enormous extent and remarkable thickness. Their general compactness is also a notable feature. At the same time it can hardly be claimed that these facts aid materially in settling the question at issue. The same may be said of the growth of forest trees upon the site. A fine chestnut tree fully a century old stands upon the surface of a bed of refuse which is filled with artificial remains, and that to a depth not even penetrated by the strongest roots; but the age of a tree or of many generations of trees will not carry us back beyond the period of the Indian.

The deposits are deep, but their accumulation may have been rapid, and the indications are strong that it was rapid. They are compact in parts, indicating, perhaps, a considerable lapse of time; but in other parts they are not at all compacted, and the pockets of coarse refuse are, as I have already shown, quite open and full of cavities—a condition not regarded by geologists as consistent with great age. So far as my excavations extend, there is no indication of a break in the period of occupation, and the implements are alike from bottom to top. Again, the evidences of accumulation and excavation are still apparent upon the surface, and this indicates a date the remoteness of which is to be reckoned by centuries rather than by tens of centuries.

That but a single stage of culture is involved and that a single race was concerned are clearly shown by the uniform character of the relics and the manner in which they occur. In one case a small pocket of refuse was encountered at a depth of forty inches, from which all the tools, flakes, and fragments were preserved. Subsequently, when these were washed and examined, they were found to include one entire typical turtle-back, which had apparently been thrown aside because of its great thickness; all the fragments of an implement quite well advanced in the second stage, but which had been broken in attempting to remove a hump, and a blade in the final stage which had been broken at the very verge of completion. The chips struck from these objects were in the cluster with them, and there can be no doubt that all these forms, covering the whole range of so-called tools from the rudest turtle-back to the final blade, were made by the same man and on the same day and probably within a single hour. Unity of time as well as of race are thus demonstrated.

The question as to the remoteness of the time has already been reviewed, and the question of the race concerned may now receive a moment's attention.

It would seem from what has been said that geologically there is nothing to carry the history of man in this place back beyond the age of the Indian, and that a number of things conspire to confine it to that period.

I find no evidence of a cultural kind that points significantly towards another race. Mining and quarrying are well-known accomplishments of the Indian, and on Rock creek and near at hand are soapstone quarries that no one would think of attributing to any other people. The mounds and shell heaps which are known to be of Indian origin bear equal or greater evidence of antiquity than do the remains upon this site.

The absence from this site, so far as known, of finished tools of flaked or polished stone and of pottery has given rise to the assumption that the race concerned did not make or use these things, and it is argued from this that they could not have been our Indians; but it would seem that there is really little apparent reason why any people quarrying boulders and roughing out rude implements in the hills should carry finished tools into the pits, and there certainly would be no excuse whatever for having pottery there. Besides, it should be remembered that my excavations have been carried over a very small portion—one-thousandth part, perhaps—of the workshops, and that other classes of art remains may yet be found.

The unity of the art of the quarries so far as known is, as we have seen, easily and conclusively shown. Is it not also possible to demonstrate the unity of the flaked-stone art of the whole Potomac province? A review of the field makes it clear that if the theory of the occupancy of this valley by an early man had not been suggested from without there would have been no occasion for asking such a question, for every appearance indicates homogeneity not only in art, but in race as well.

The flaked-stone implements of the region are readily grouped under a few heads, including knife-blades, scrapers, spear-points, arrow-points, and perforators. Other forms are known, but they are not of importance in the present study and at best were not standard products of the flaking art, but rather emergency tools made to answer some temporary or purely local purpose.

Two of the groups, the arrow and spear heads, are perhaps the

most numerous and important, as they naturally would be with a fishing and hunting race. They include wide but closely similar ranges of form, the two classes varying little save in size, and this difference may be easily accounted for by differences in the material. Quartz is fitted for the manufacture of small forms only on account of its brittleness, lack of homogeneity, and flawed condition, whereas quartzite is tough, coarse-grained, and fairly homogeneous, and while well adapted to use for large tools is difficult to shape into small or delicate ones. Jasper, slate, flint, and other rocks are comparatively rare and from necessity occupy a secondary place in our primitive art. To all appearance the differences in size are reasonably accounted for without appealing to distinctions in culture or race to explain them.

Now, for the purpose of securing another point of view from which to study the quarries and the quarry products, let us suppose that no example of the workshops had been discovered, and that the source of supply of the raw material was wholly unknown. Viewing the vast number of spear and arrow heads of quartzite found scattered over the hills and valleys and taking into account the multitude that still lie buried in humus and alluvium, the question would naturally arise, where are the sources of the material, and where are the great quantities of refuse that must have resulted from such extensive manufacture?

Nearly all of the quartzite found in this region is in the shape of boulders, and we are safe in concluding that in the manufacture of ten thousand tools—a moderate estimate of the number lost within this valley—hundreds of thousands of failures were made and millions of flakes and fragments were left upon the ground. It has been observed that these boulders are scattered over the surface of the country, and in many places they have been worked, but they occur in very limited numbers, and having been seasoned by long exposure they are extremely difficult to reduce to desired shapes. Through the investigation of Mr. McGee we have learned that the area affording a plentiful supply of quartzite boulders of a size suitable for use in shaping tools is very limited, and that it is confined to the bluffs of the Potomac river within and immediately below the District of Columbia, and it follows from this that the factories where implements were made and the refuse resulting from the manufacture must be found within the range of vision from our house-tops.

But, as we have seen, the quarries and factories have actually been found, and it is ascertained that they answer in every way the requirements of the case.

Every quartzite point made from a bowlder had to go through all the stages of manufacture already carefully described, and with these quarry workshops in sight it would be absurd to still ask where and how these implements were made. It is impossible to escape the conclusion that these quarries were the source of the material, and that here the implements were roughed out, and the presumption is very strong that the quartzite art of the valley is a unit, and that but one people was concerned in the manufacture and use of the implements.

It follows still further, since the quartzite shapes are identical with those in quartz and other materials, that the chipped-stone art of this valley is practically a unit, and that nothing short of the discovery of wholly new evidence will make the theory of occupancy by another race than the Indian tenable.

Notwithstanding the apparent conclusiveness of the evidence of ethnic and cultural unity, the lessons derived from other regions should not be disregarded. The interpretations placed upon implements found elsewhere and corresponding closely to ours are eloquent of the history of early races and of the evolution of culture.

Many of the rude implements of the Seine—assigned to a great antiquity and to an unknown race—are nearly identical with our quarry forms. On the Thames the analogues of nearly all classes of rude implements are found in the high, level gravels, thus carrying history back with certainty to remote ages. In the Delaware valley the rudest forms, corresponding to our failure shapes, are obtained from glacial gravels, and the less rude varieties occur in more recent formations or under conditions that seem to make them safe indices of the steps of progress. In the Potomac valley, on the other hand, all the rude forms appear to be but failures or unfinished pieces representing stages in the manufacture of arrow and spear points of the Indian.

In view of this apparently anomalous state of affairs it may be held that as in biology the growth of the individual epitomizes the successive stages through which the species passed, so in art the flaked-stone tool of the highest type advances through stages of manufacture each step of which illustrates a period of human progress in culture.

It should be remembered, however, that the investigations of this locality are not yet completed, and that in view of this fact it would be unwise to assume that in all cases final results have been reached. It is quite possible that our chipped implements are in a measure separable into chronologic or cultural groups, for the American Indian did not always occupy one plane. In common with other divisions of the human family he must have risen by degrees from lower to higher levels of culture. The chipped-stone art, however, in itself a simple one, may have reached comparative excellence rapidly and in very early times, and far in advance of more complex and less practical arts. In any event it is probably not very sensitive to cultural changes, and may have remained for a long time practically stationary while the procession of other arts moved steadily on.

It is believed by Mr. McGee that the river gravels formed in the Potomac valley since the first ice epoch and possibly containing evidences of early man have been depressed beneath tide water. If such is the case, we are as helpless here as our confreres at Trenton would be if the estuary gravels of the Delaware, now yielding such important finds, had sunk wholly from sight in pre-Columbian times.

It is within the range of possibility that other classes of evidence may yet be forthcoming. The discovery of shelters, caves, or village sites occupied by distinct peoples or by the same people at widely separated periods, or of human remains in connection with the remains of extinct animals, would throw new and strong light upon the early history of man in this valley.

As to the present state of the evidence, I hold that there can be but one opinion. It is impossible to show that there exists the slightest trace of any other race than the American Indian as he is known to us, and I am convinced that if the great Powhatan should at this late day rise from the dead and claim for his people all the stone implements of the Potomac valley no reasonable objection could be made to the claim.

SUMMARY.

And now a few of the salient points brought out in the preceding pages may be recalled:

A quarry workshop of the flaked-stone implement makers has been identified, examined, and described.

The quarrying is found to have been extensive and the remains are of surprising magnitude.

The manner of quarrying, the material quarried, and the purpose of quarrying have been studied.

The processes of manufacture have been determined and the articles manufactured have been described.

It has been shown that percussion was used exclusively, and that any people chipping ordinary implements from boulders must necessarily follow the same steps and reach similar results.

It has been shown that a well-marked distinction exists between quarry work, which is a roughing out by percussion, and the after shaping and finishing of special forms, which is accomplished chiefly by gentle means, such as pressure, and that it is highly improbable that the latter work would be conducted upon the same site as the former.

The true nature of a workshop has been defined, and the occurrence of rude forms or failures in or their absence from certain localities is thus reasonably accounted for.

It has been shown that the blade alone was carried away from the quarry, that it is the cache form, and that it, with the whole range of forms naturally derived from it, are found upon village sites and elsewhere.

That all or nearly all our quartzite tools have been derived from boulders obtained in the Potomac valley near Washington, and that there is every reason to believe that these quarries on Rock creek are the main source.

That all chipped implements known to have been generally used in this valley are thin forms, such as the knife-blade, the spear-point, the arrow-head, the perforator, and the scraper, and that all these are typical Indian forms, and that the art remains are practically a unit.

That the existence here of another and a more ancient race than the Indian has been predicated upon a class of objects which, being mere refuse, have of themselves no ethnic or chronologic significance whatever.

That our geologic evidence is extremely slight, but that what there is seems to be rather against than for great age for the period of occupation.

And, finally, that all visible evidence so far collected, chronologic, cultural, and ethnical, point to the Indian as the laborer in these quarries and as our only predecessor in the Potomac valley.

In conclusion, let me say that I am ready to modify any of the above statements, inferences, and conclusions when the facts are found to warrant the change, and that I shall seek earnestly for evidence of antiquity, and shall heartily welcome the appearance of an early man upon a field of investigation whose interest will be quadrupled thereby.

IN NEARLY every community may be found one or more enthusiastic devotees of archæologic research, many of whom are actively engaged in collecting relics of ancient art. It is rather exceptional, however, to find the work systematically carried on ; to find adequate records kept and proper care taken of the collections, and these are prime considerations to those who would make their treasures available for scientific purposes. It is the collector who attends to these matters, and especially he who at the same time devotes himself to particular localities, who becomes in time the benefactor of archæologic science.

The Potomac Valley is a fine field for the collector and student, and this fact becomes more apparent every year. From the Apalachian region, meandered by the Upper Potomac, Mr. F. M. Orfut, of Cumberland, has amassed a most valuable collection. Mr. Hallett Phillips, S. V. Proudfit, and E. R. Reynolds, of Washington, have each a large series of valuable relics. That of Mr. Phillips illustrates a narrow belt bordering the banks of tide-water Potomac, while the others are somewhat more general. The collection of Mr. J. D. McGuire, of Ellicott City, Maryland, is more than usually important. It represents the region lying between Chesapeake Bay and the Lower Potomac, and is noticeable for a number of unique features. Among these is a series of the products of the ancient soapstone quarries of the region, including many roughed-out pots and a remarkable series of rude pick-like tools of stone, used in quarrying and shaping the vessels ; also a number of superb sets of cache finds.

Mr. N. S. Way and Mr. Wm. Hunter, of Mount Vernon, and Mr. O. N. Bryan, of Marshall Hall, with several others, have done excellent work, and many of these gentlemen have contributed all or a large part of their valuable finds to the National Museum.

W. H. HOLMES.